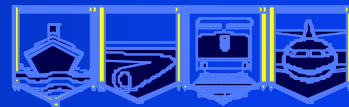


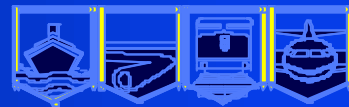
# **Tools for Safety Management: Considerations for the Design of Occurrence Data**

**Maury Hill  
Manager, Macro Analysis  
Transportation Safety Board of Canada**



# ACCIDENT INVESTIGATION

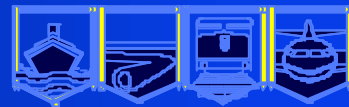
## *Traditional Approach*



# ACCIDENT INVESTIGATION

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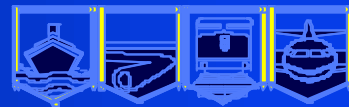
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WHAT?

WHEN?

WHO?

WHY?

HOW?



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WHEN?

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- ◆ Accident reports seldom depicted:

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Applied to data collection as well







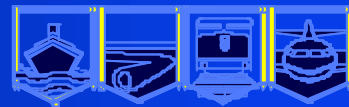
# TSB APPROACH





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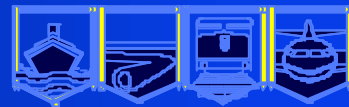
- ◆ Advance Safety through the identification and validation of *Safety Deficiencies* that are found through the investigation process





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**Changes to database**



# *Why Collect?*

**Macro  
Analysis**

**Occurrence  
Assessment**



# *Why Collect?*

**Macro  
Analysis**

**Occurrence  
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# *Why Collect?*

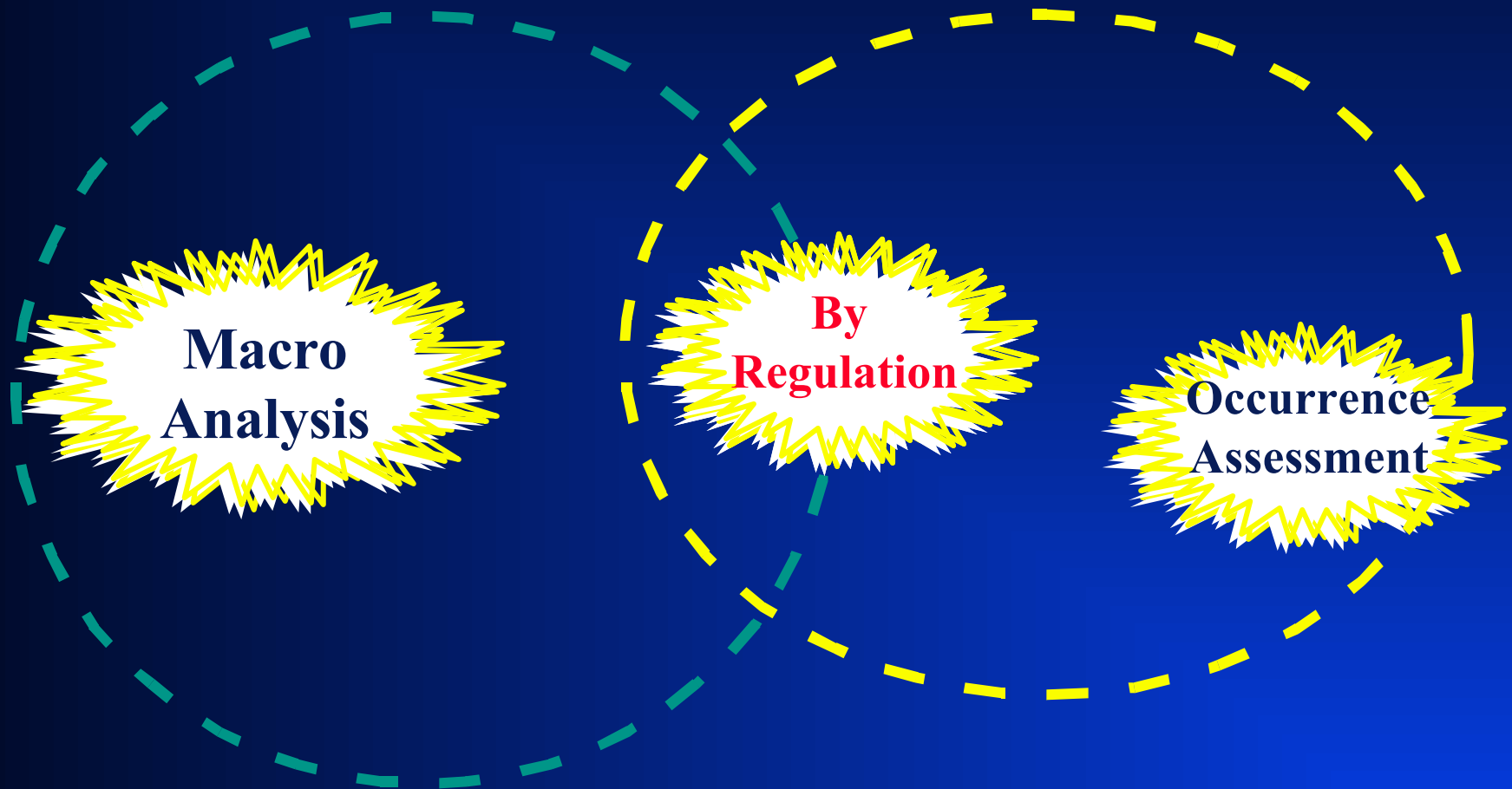


**Macro  
Analysis**

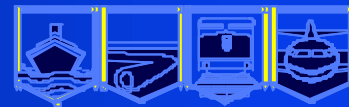
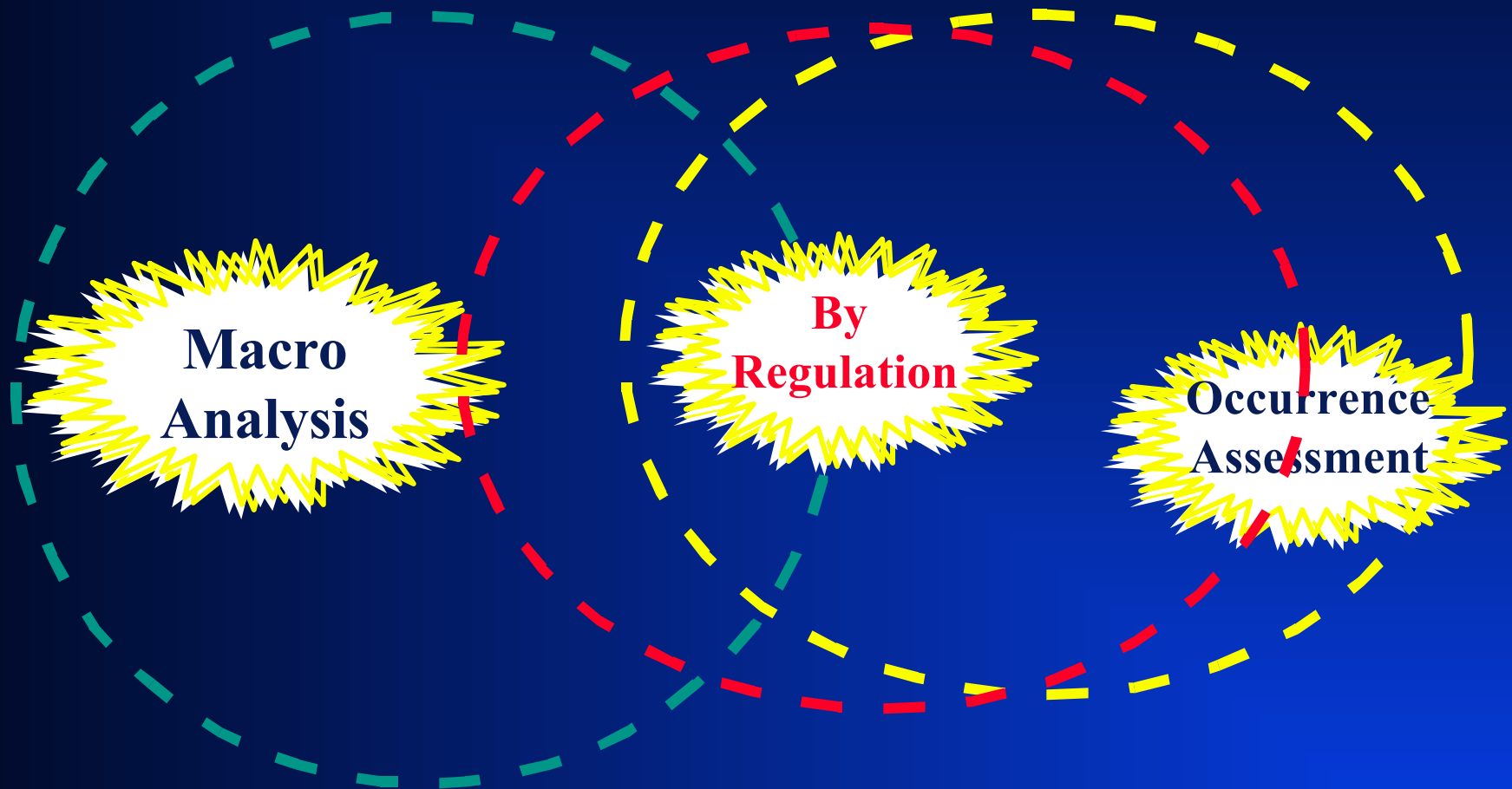
**Occurrence  
Assessment**



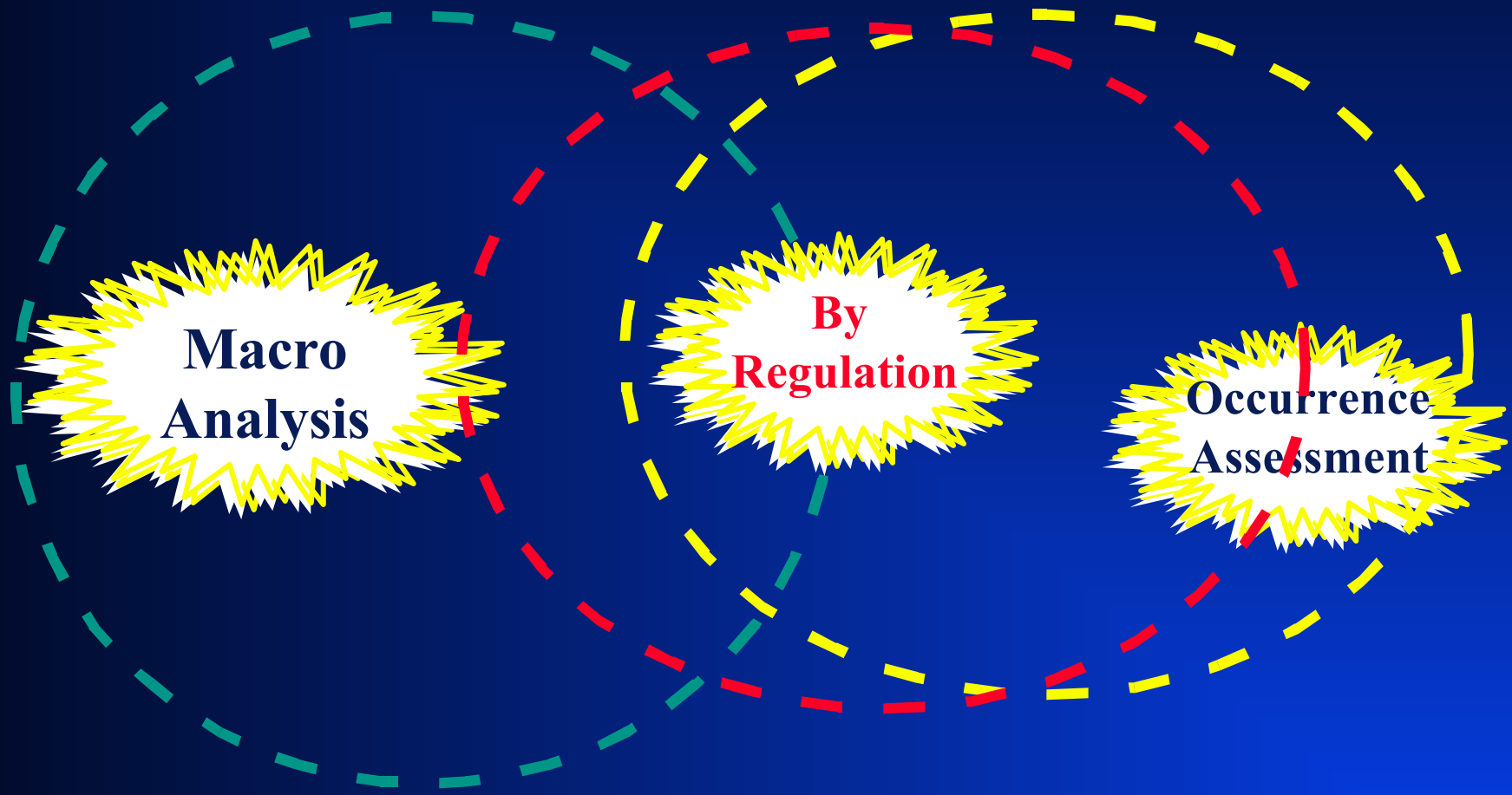
# *Source of Data*



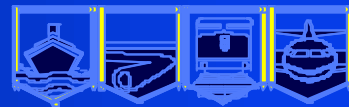
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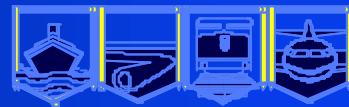
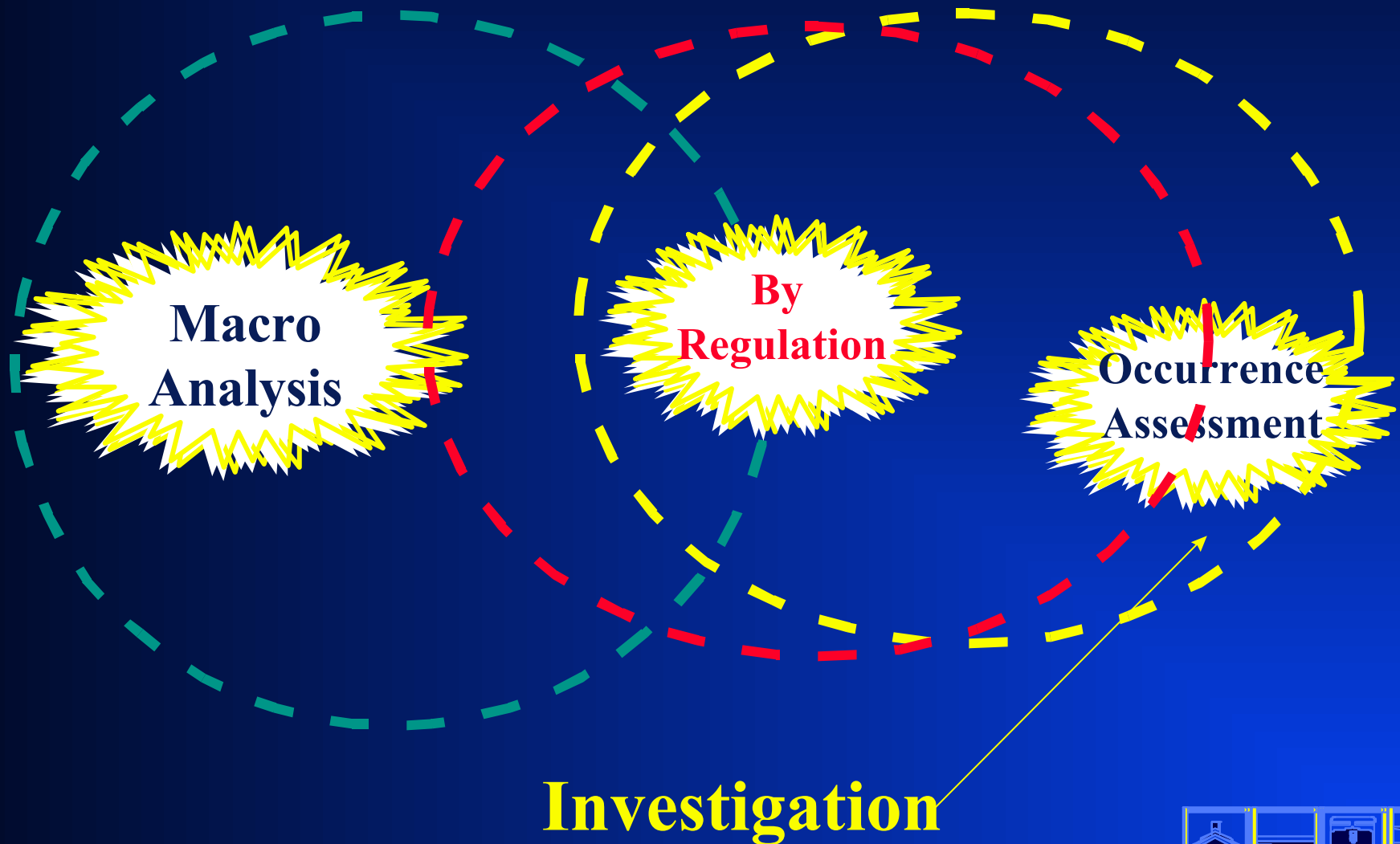
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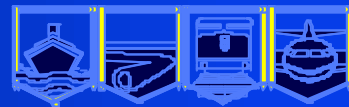
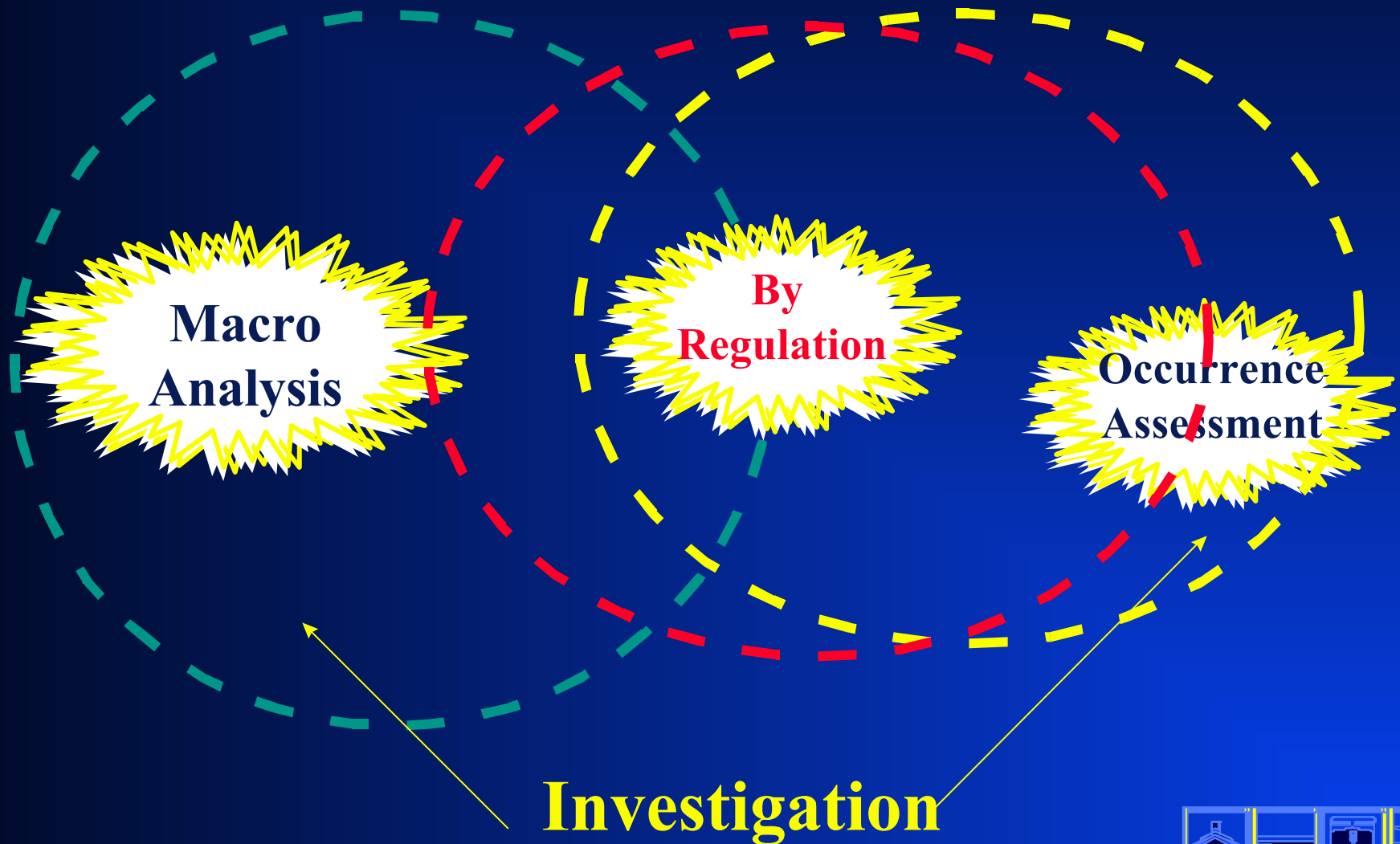
**Investigation**



# *Source of Data*



# *Source of Data*



# *Why Collect?*



# *Why Collect?*

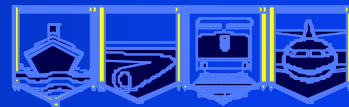
- ◆ data are required to assess problem size and characteristics, to establish trends, and to decide between and evaluate risk control options.





# *Why Collect?*

- ◆ data are required to assess problem size and characteristics, to establish trends, and to decide between and evaluate risk control options.
- ◆ a reporting system can provide a bank of data sufficient to establish broad accident categories and provide detailed information on accident causation.



# *Why Collect?*



# *Why Collect?*

- ◆ Occurrence most often have happened before



# *Why Collect?*

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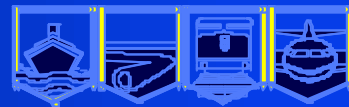
# *Why Collect?*

- ◆ Occurrence most often have happened before
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  - L1011 O-Rings - 11 in past 2 years



# *Why Collect?*

## ◆ Occurrence most often have happened before

- Herald of Free Enterprise
- L1011 O-Rings - 11 in past 2 years
- Three Mile Island



# *What to Collect*





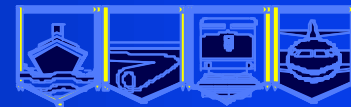
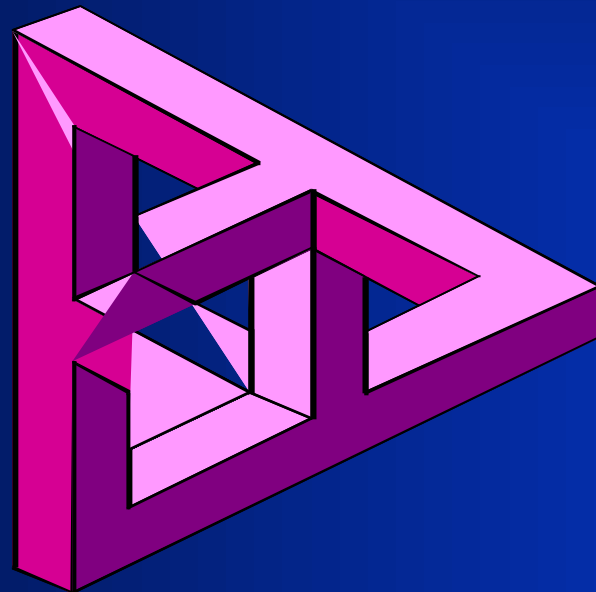
# *What to Collect*

- ◆ *“... Data held for any purpose or purposes shall be adequate, relevant and not excessive in relation to that purpose or those purposes.”*

**Data Protection Act, United Kingdom**

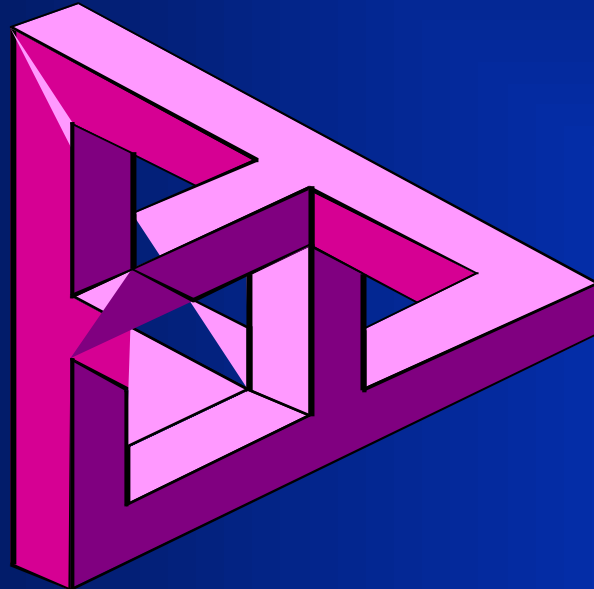


# VOLTAIRE



# VOLTAIRE

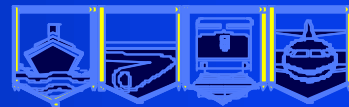
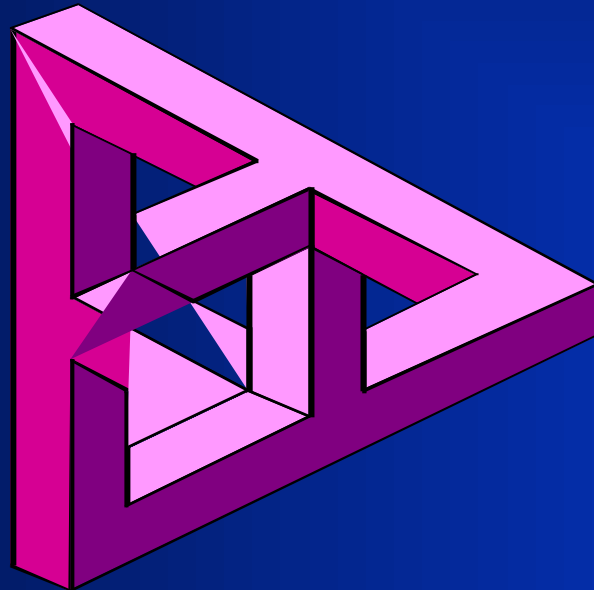
*“There are no such things as accidents.”*



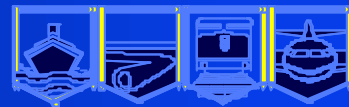
# VOLTAIRE

*“There are no such things as accidents.*

*What we call by that name is the effect  
of some cause which we do not see.”*



# *Definitions*



# *Definitions*

- ◆ **Restrictive definitions of reportable occurrences have a profound impact on our work.**



# *Definitions*

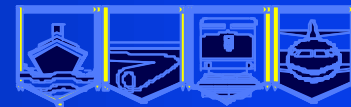
- ◆ **Restrictive definitions of reportable occurrences have a profound impact on our work.**
- ◆ **All definitions are of necessity restrictive:**
  - **simple expediency**
  - **expressions of limited professional interest**



# *Accident causation is layered like an onion.....*



- *Individual performance*
- *Crew performance*
- *Design & Operating Standards*
- *Supervision and training*
- *Company safety management*
- *Regulatory compliance*





*Accident causation is layered  
like an onion.....*

*Each layer represents  
a set of safety conditions.*



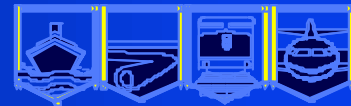
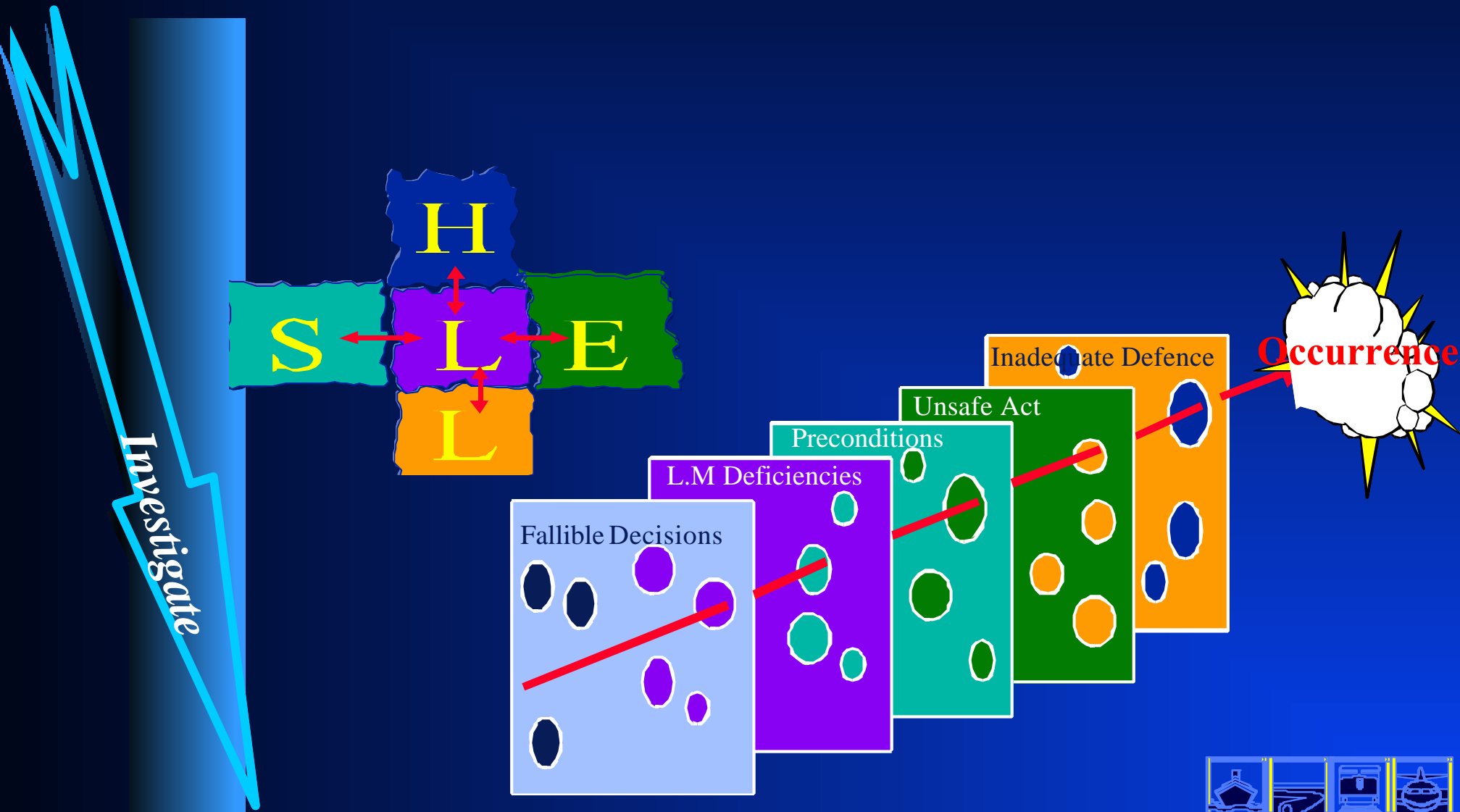
- *Individual performance*
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Occurrence

Initial Assessment

# *Investigation Methodology*



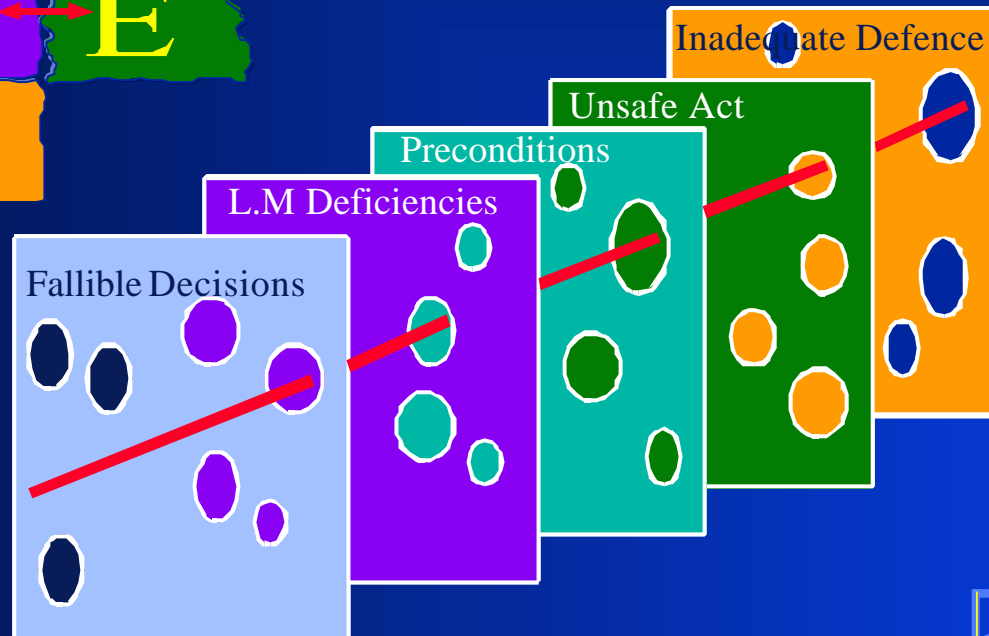
Occurrence

# Investigation Methodology

Initial Assessment

Data Collection

Investigate



Inadequate Defence

Unsafe Act

Preconditions

L.M Deficiencies

Fallible Decisions

Occurrence

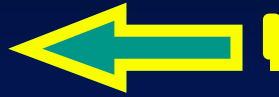


Occurrence

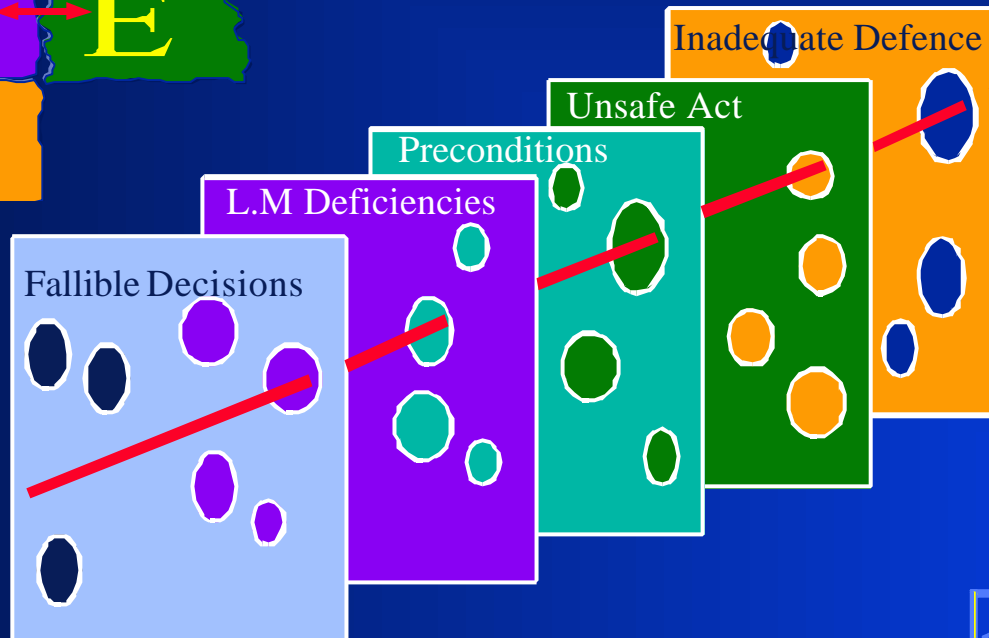
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Data Collection



Investigate



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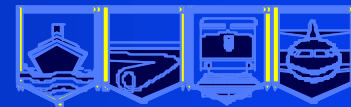
Unsafe Act

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Occurrence

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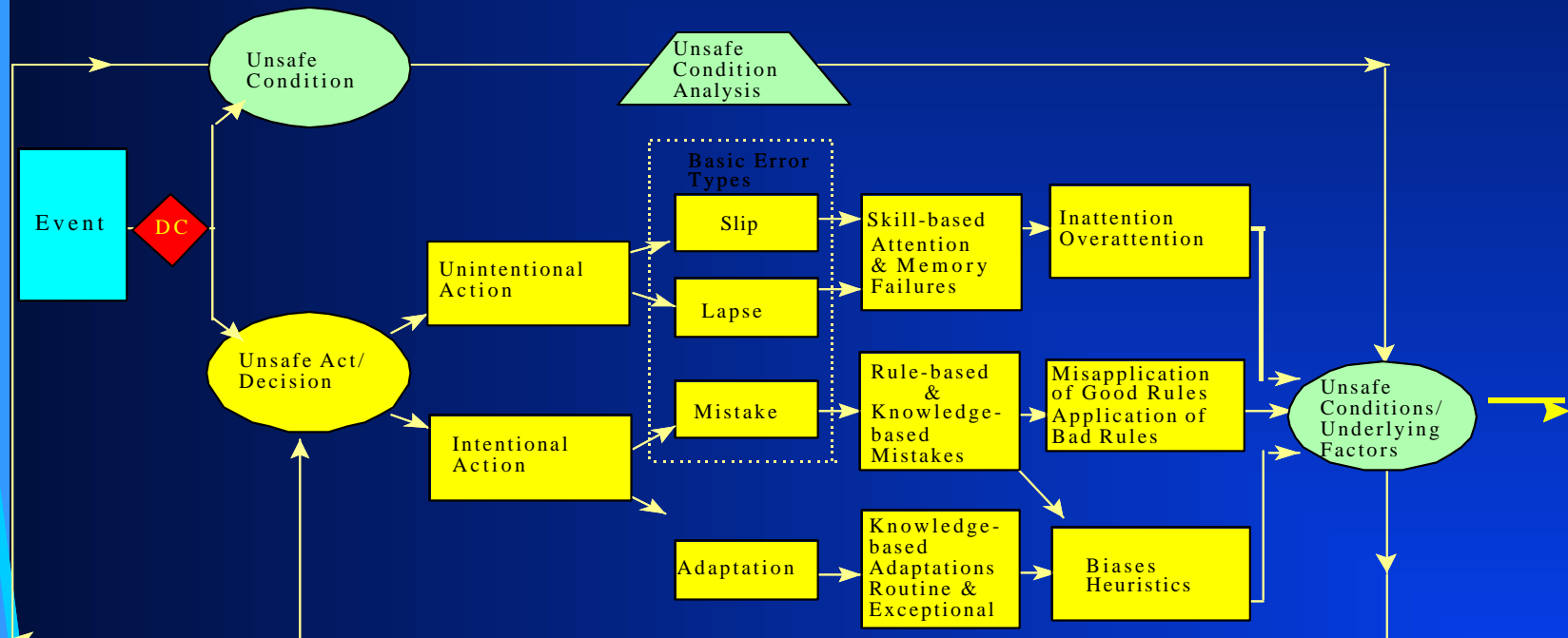
Reference Events

# Investigation Methodology

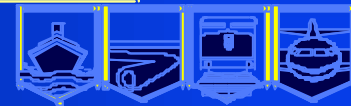
Events & Factors Analysis

Integrated Investigation Process

Investigate



DC = Decision Criteria



Occurrence

Initial Assessment

Data Collection

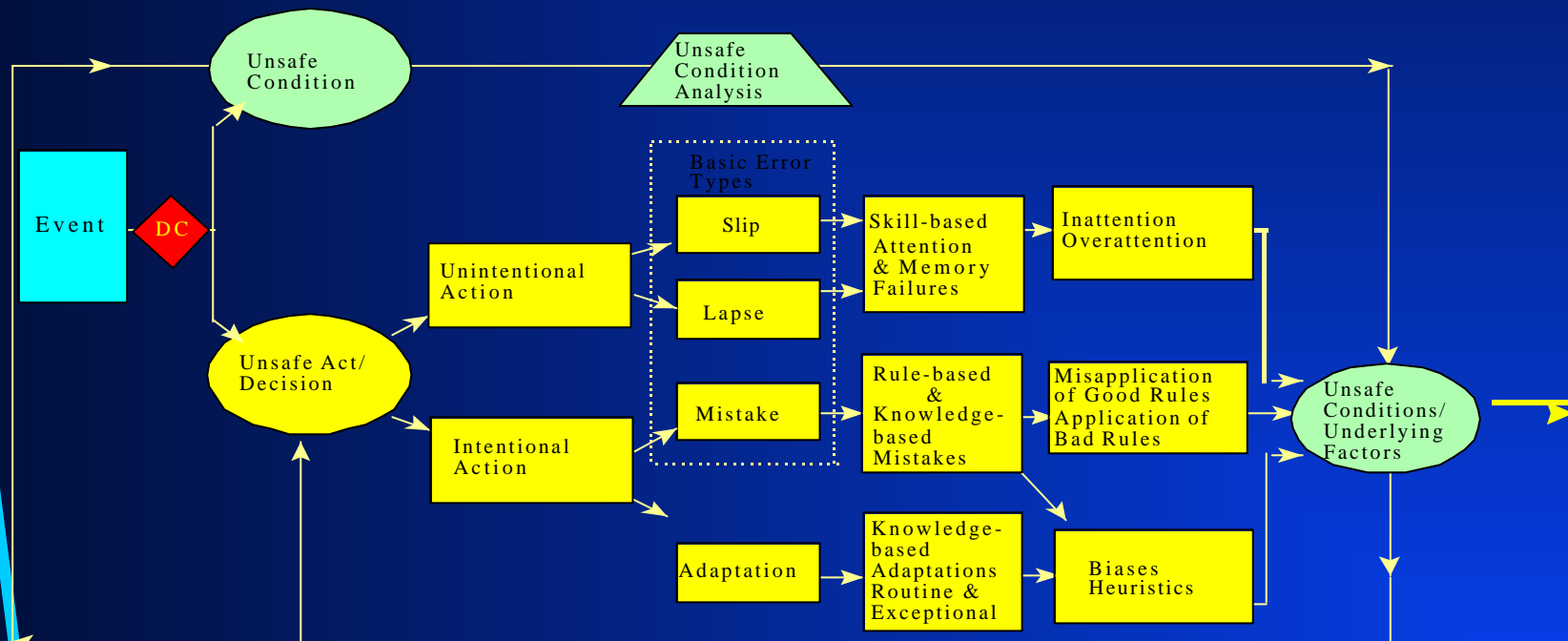
Occurrence Events

Unsafe Acts/Conditions

# Investigation Methodology

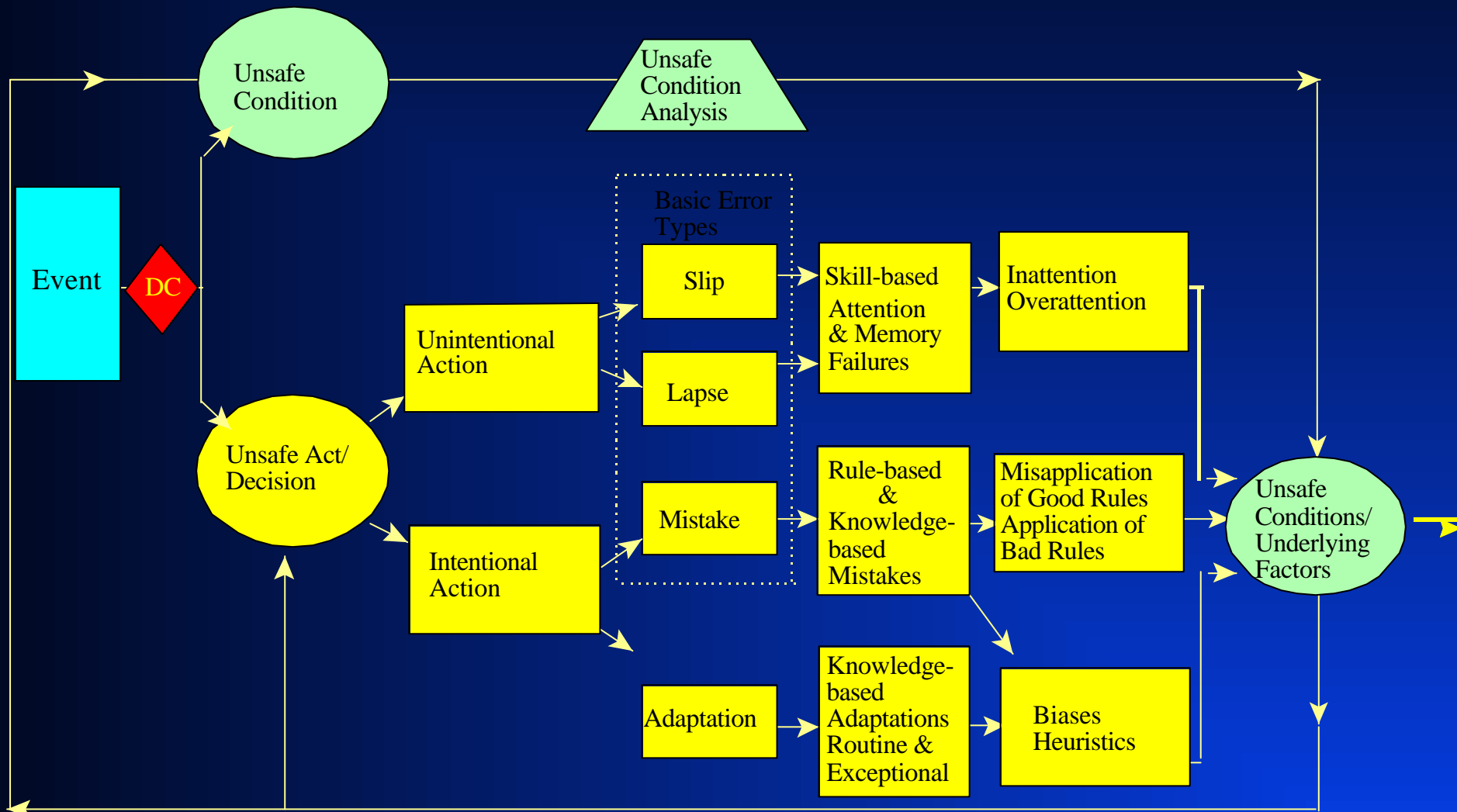
Events & Factors Analysis

Integrated Investigation Process

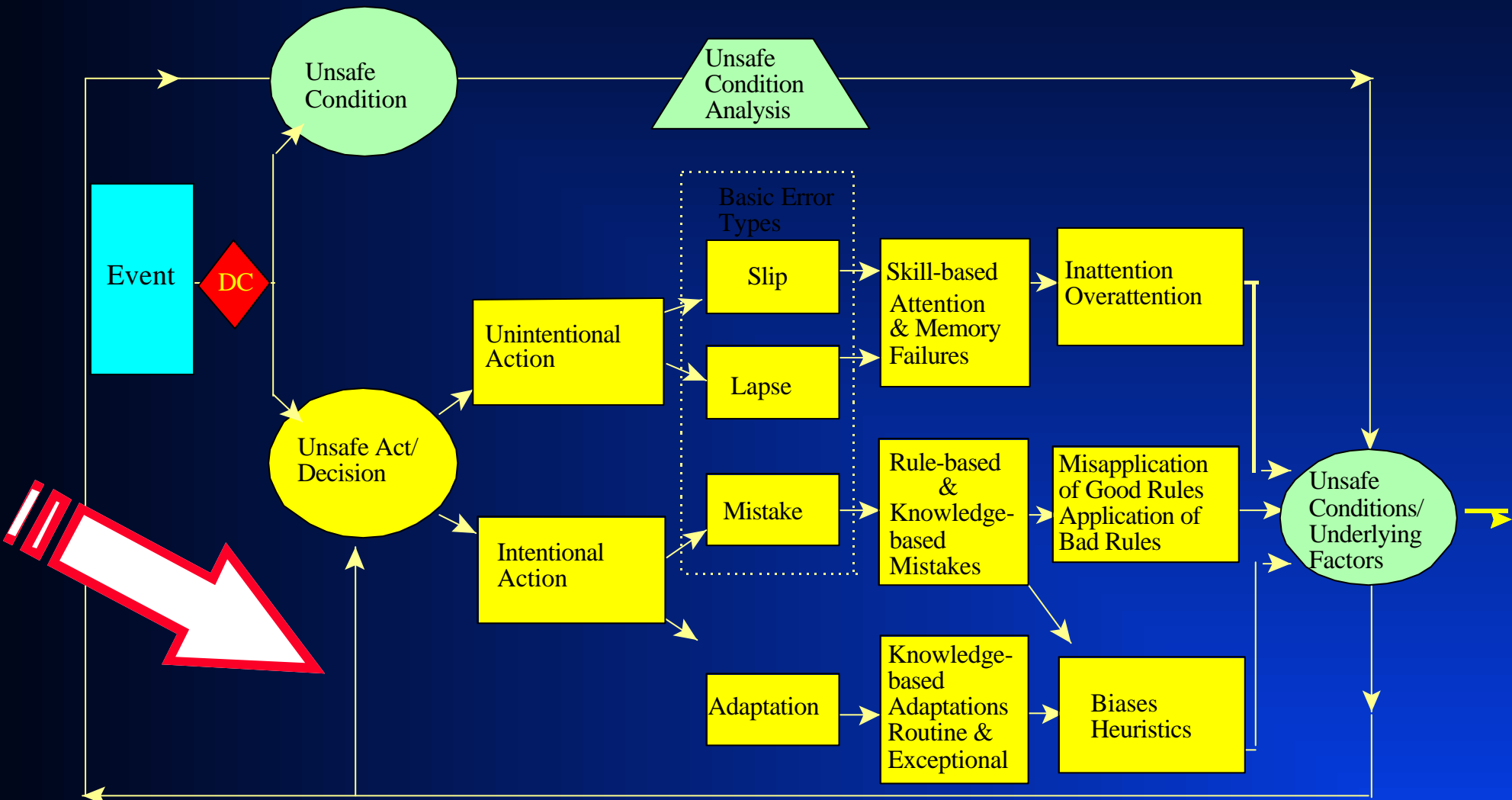


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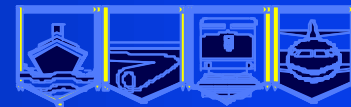
# Integrated Investigation Process



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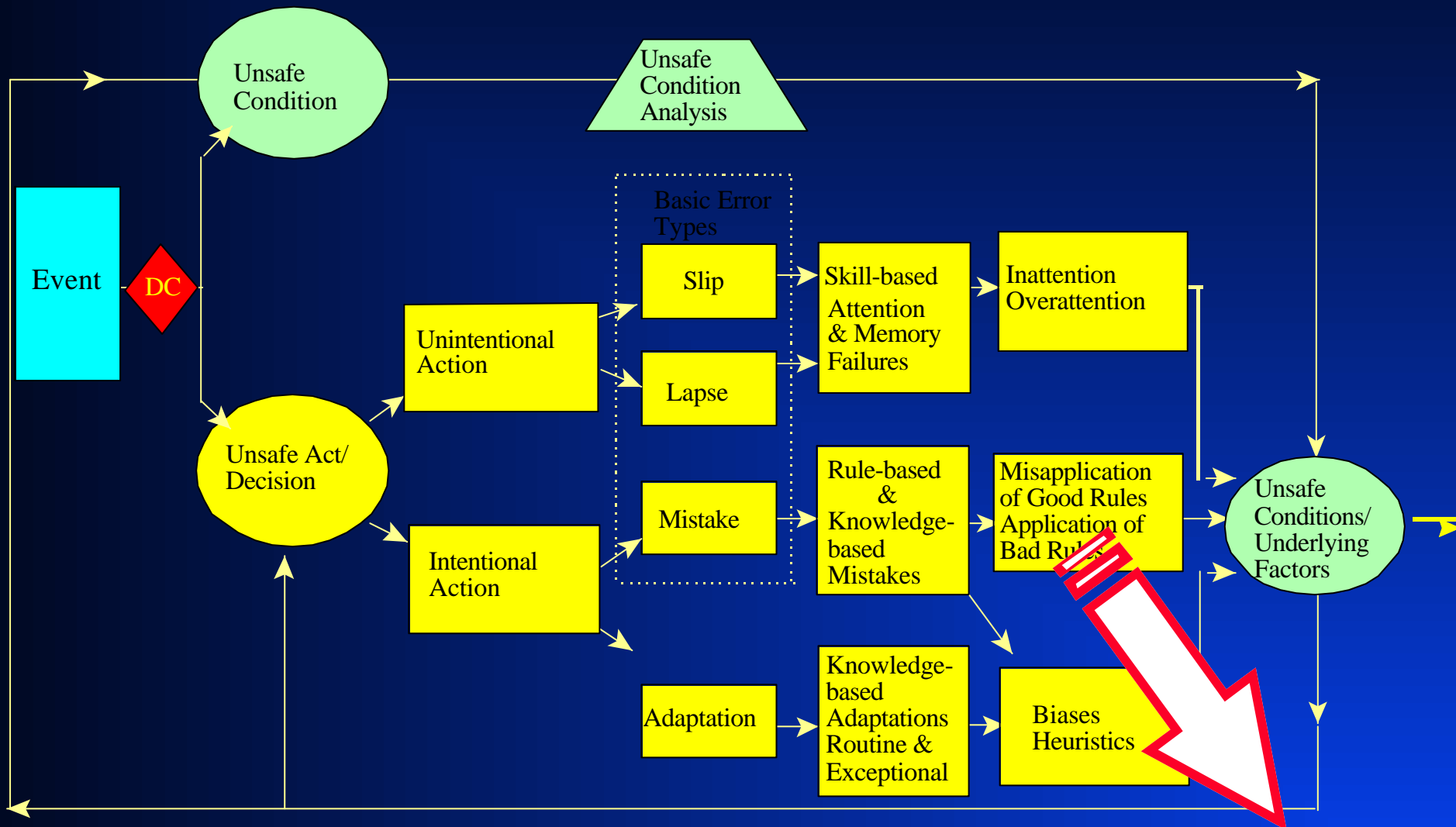


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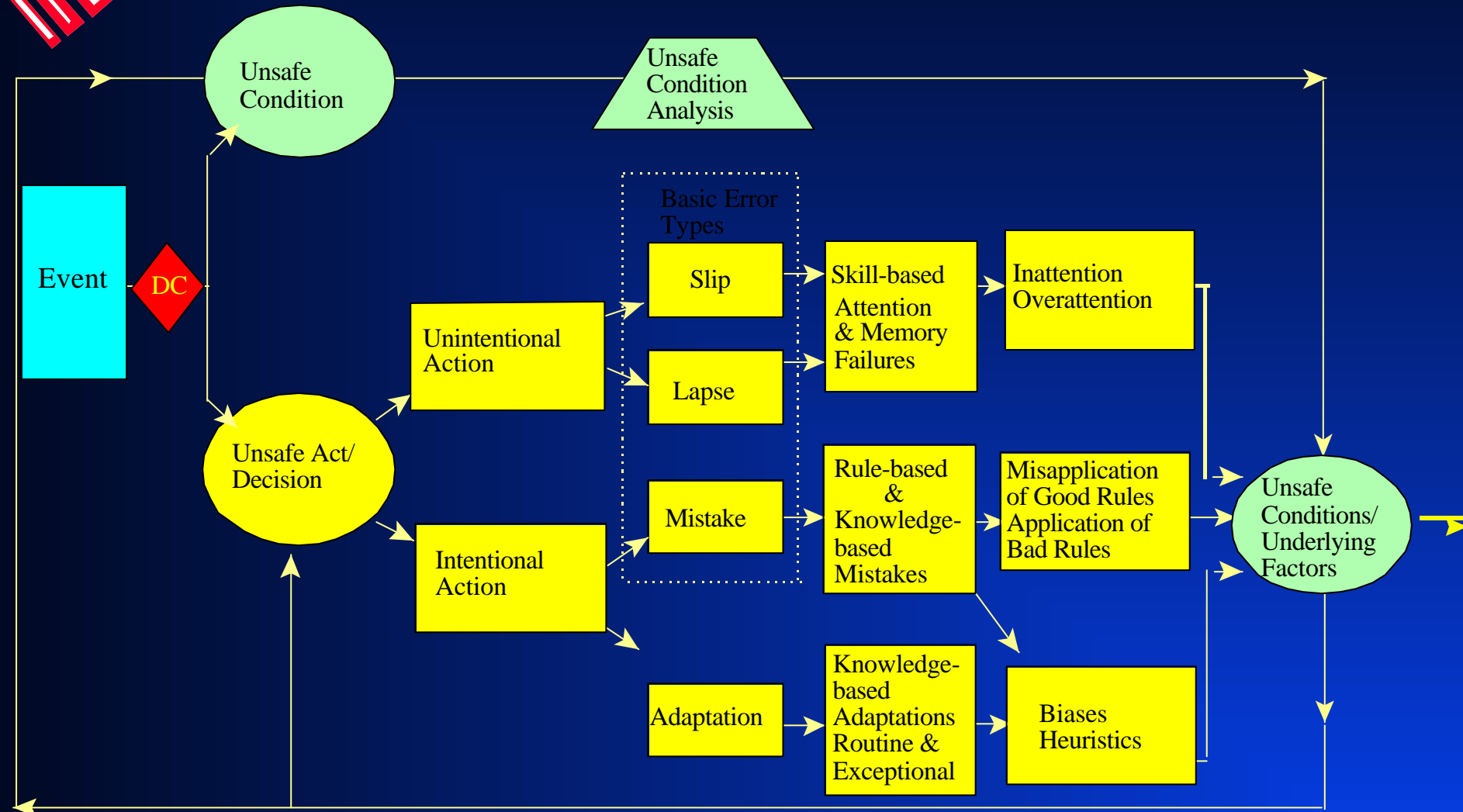
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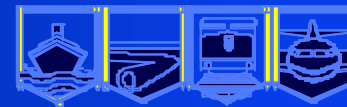
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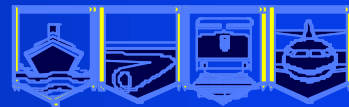
# Integrated Investigation Process



DC = Decision Criteria



# *Need for Taxonomy*



# ***Need for Taxonomy***

- ◆ **Should be founded in science - have construct validity, not just face validity**



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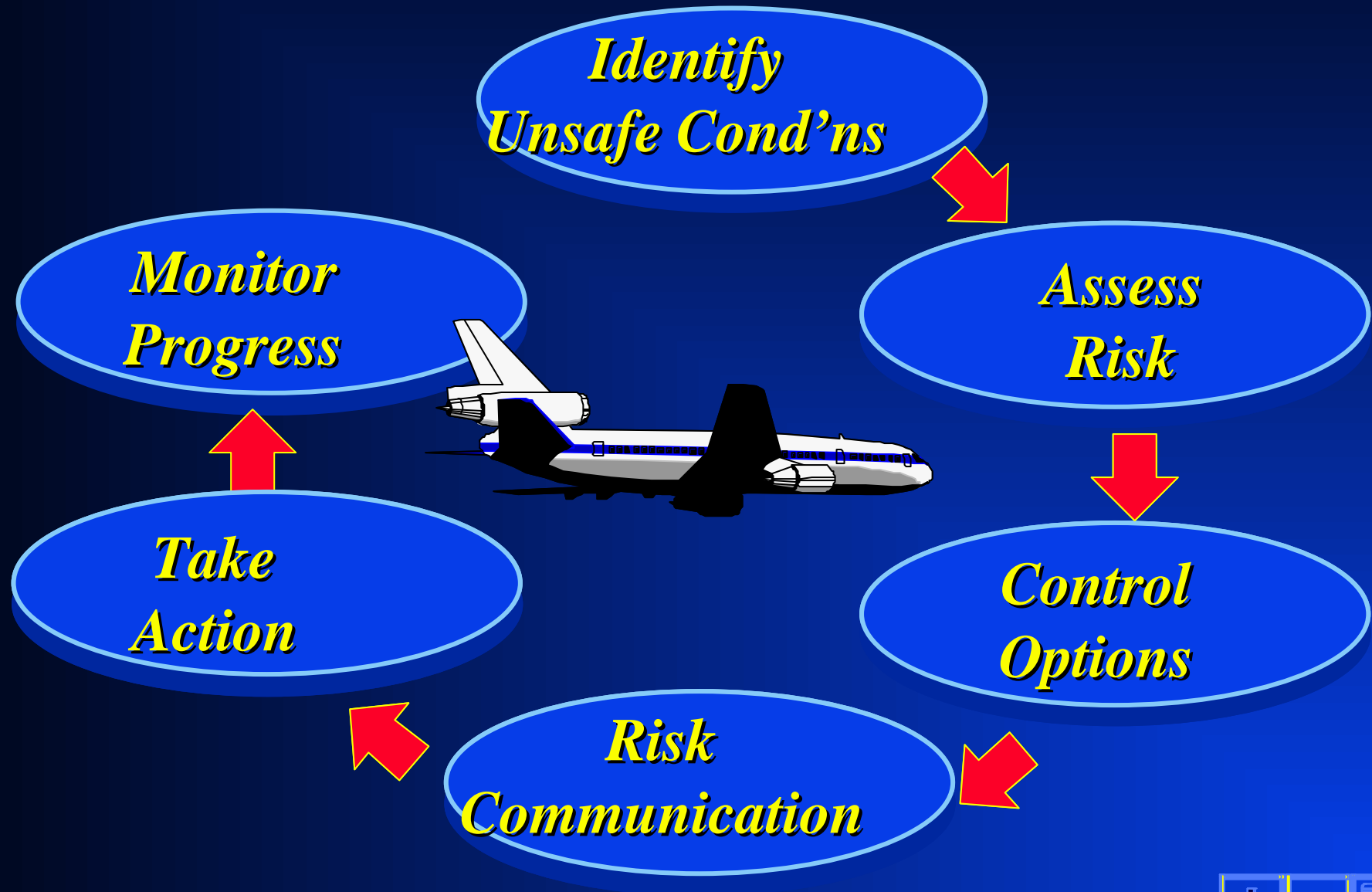


# ***Need for Taxonomy***

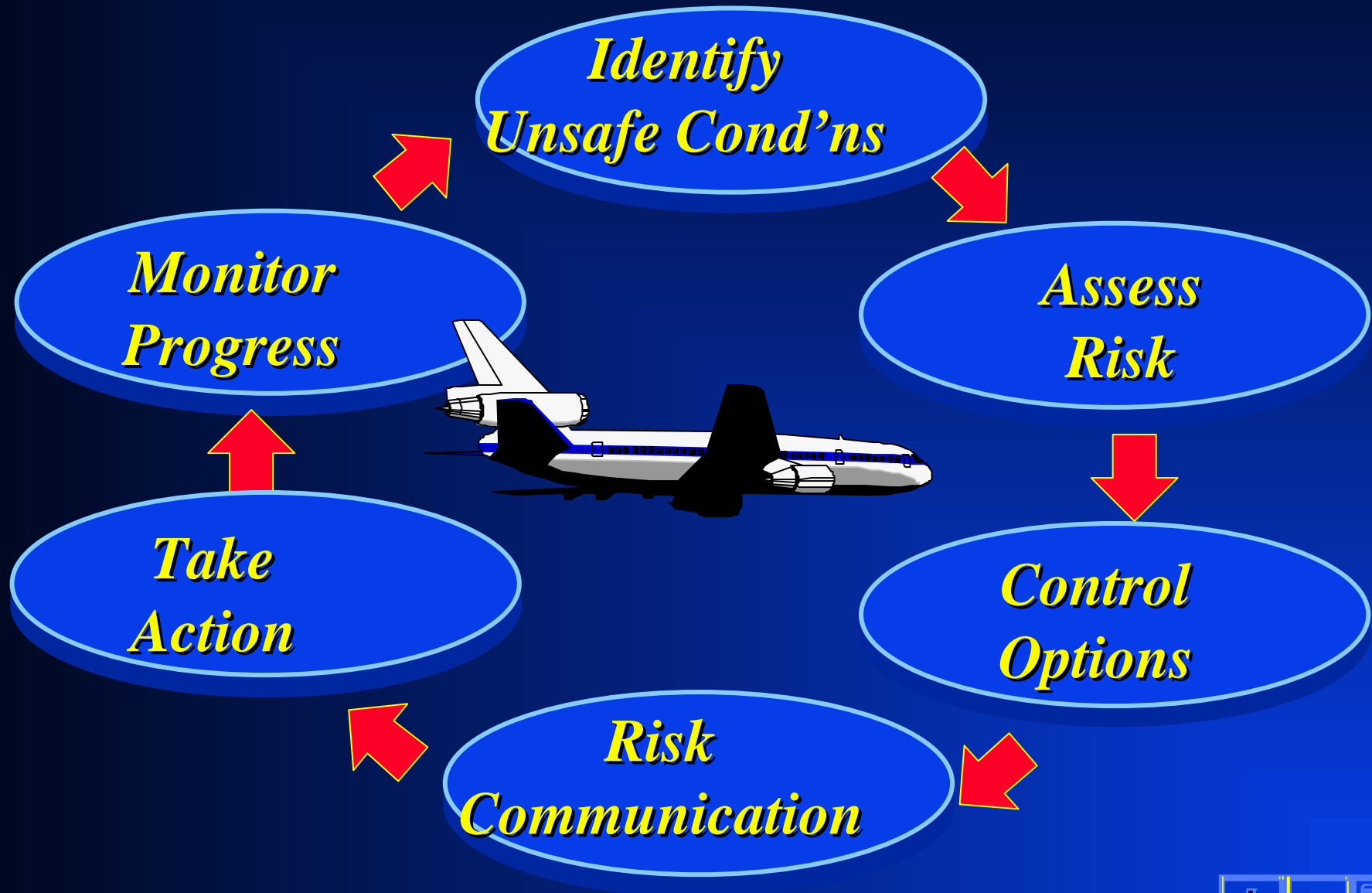
- ◆ **Should be founded in science - have construct validity, not just face validity**
- ◆ **Should be able to give insight into accident causation**
- ◆ **Need for taxonomies for error *and* underlying factors**



# Accident Prevention *Process*



# Accident Prevention *Process*





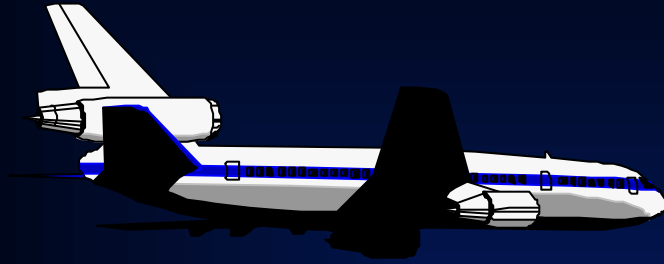
# Results?



# Results?

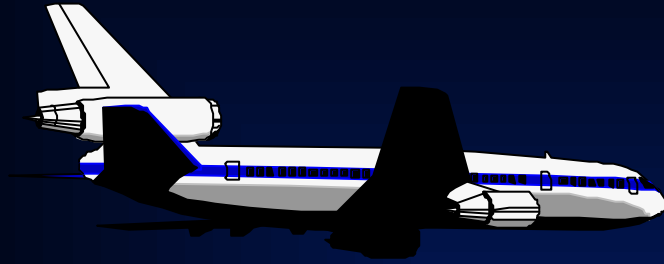
*Our commitment  
to improving aviation safety data  
through human factors initiatives  
will pay a safety dividend?*





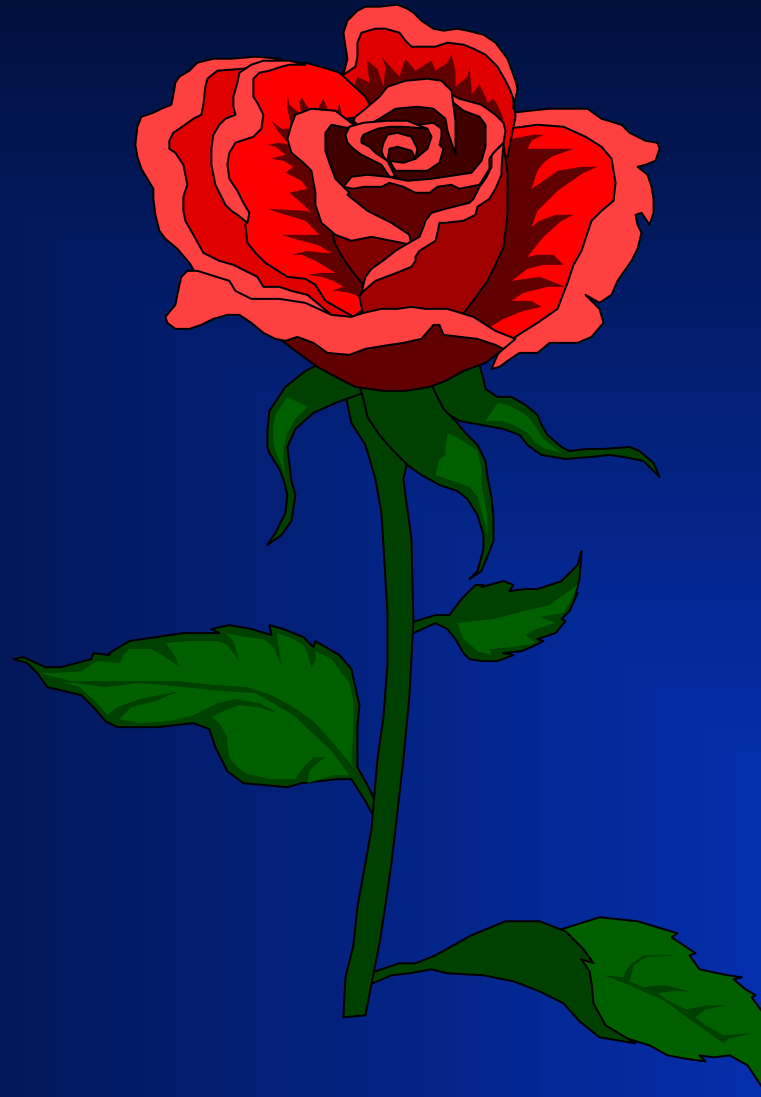
- ◆ “... it is impossible, while designing a database, to anticipate every type of data analysis that might be required in the future, (therefore) it is to be anticipated that any database will be lacking with respect to its ability to support macro analysis projects. The implication of this is that for most macro analysis projects, it should be anticipated that some data collection will be required.”

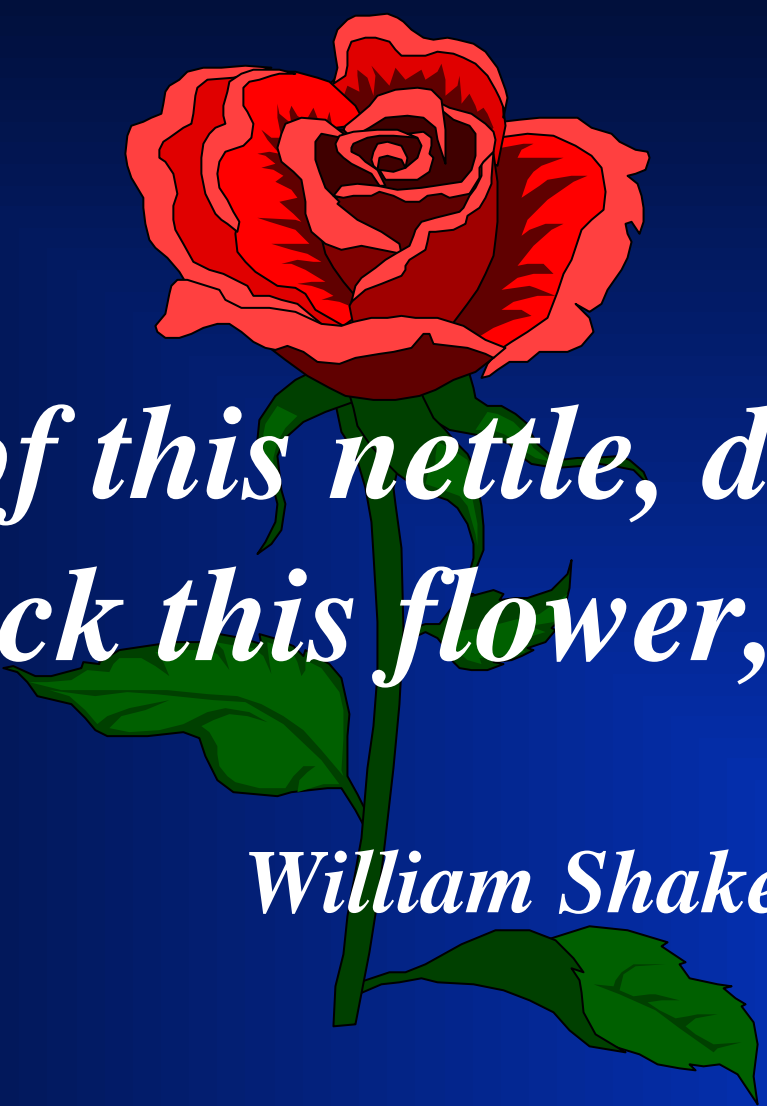




- ◆ data quality issues
- ◆ currency of data
- ◆ etc., etc., ....







*“Out of this nettle, danger,  
we pluck this flower, safety.”*

*William Shakespeare*

